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STUDENT COURSE FEEDBACK PATTERNS IN CORRELATION WITH THEIR
MOODLE EXPERIENCE

MA Thesis

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Abstract

Student Course Feedback Patterns in Correlation with Their Moodle Experience

With the use of online learning management systems in educational institutions, it is every faculty's and course creator's responsibility to provide quality content not only in their face-to-face classes but also in their online learning management systems. Many researchers have researched the online learning management system tools that help to create an online course environment that motivates and engages the student. Moreover, a motivated and engaged student then becomes a satisfied student. With the rising number of students and courses in a higher education institution, it is difficult to overlook the quality and content of each course provided in the institution. Therefore, it is essential to have guidelines for creating an engaging e-course, and to follow them. This study first provides an overview of related research done to analyze the tools and methods, used in providing quality content using online learning management systems that have been proven to increase student motivation, participation, collaboration and also student satisfaction with their studies in general. The study then analyzes 119 courses, taking place during the Fall semester of 2017/2018 study year at Rīga Stradiņš University, and the corresponding student satisfaction survey results. This data is analyzed to explore the correlation between the e-environment content, overall student satisfaction with the course, satisfaction with the course's e-environment and the time students had spent acquiring the course independently. The analysis of the data shows a correlation (although not always linear) between these aspects. The results of the study highlight the importance of high quality, diverse e-course environments and show that the essential tools necessary for increasing student satisfaction (based on related research) are rarely used or not used at all in the analyzed courses. The study offers guidelines to follow when creating and managing an e-environment of a course to increase overall student satisfaction with their courses.

Keywords: Moodle, online learning management systems, student satisfaction, e-environment

Table of Contents

Abstract	2
Table of Contents	3
1. Introduction.....	4
1.1. Technology	5
1.2. Theoretical Background.....	6
1.2.1. The Importance of Online Learning Management System Moodle.	6
1.2.2. Instructional Design Principles.	9
1.2.3. Learning Communities in Open Source Management Systems.	10
1.2.4. Students' Perspective towards Online Learning Management Systems.....	11
1.2.5. Student Satisfaction in Correlation with Moodle Data.	12
1.2.6. Aims of the Study and Research Questions.....	13
2. Methods	14
2.1. Participants.....	14
2.2. Materials and Procedure	15
2.3. Data Analysis	16
2.3.1. Limitations of the Study.	16
3. Results.....	18
3.1. General Course Satisfaction.....	18
3.2. Moodle Course Environment Satisfaction.....	22
3.3. The Average Time Spent on Independent Studies Weekly	24
3.4. Activity and Resource Tools on Moodle	24
3.5. Total Clicks of Moodle Activities and Resources	26
3.6. Highest Valued Course Characteristics	26
4. Discussion.....	29
4.1. Piotrowski's Approach	29
4.2. UID Principles and Categories of Online Course Accessibility	30
4.3. Learning Communities in Open Source Management Systems	32
4.4. Students' Perspective Towards Online Learning Systems	33
4.5. Students Satisfaction in Correlation with Moodle Data	34
4.6. Recommendations.....	34
4.6.1. Recommendations for Further Research.....	34
4.7. Conclusions.....	35
Acknowledgments	36
Author's Declaration	37
References	38
Appendix 1. Student course evaluation survey example	

1. Introduction

In the 21st century, technology has become an inevitable part of most aspects of life, including education. Moreover, while technology keeps being developed at the highest speed and spectrum ever, it is a student's and faculty's responsibility to keep up with the fast-developing area.

Educational apps, tools, portals and learning platforms have drastically changed the game of education. If effectively used, these tools can become best friends of both the faculty and the student. However, even the most advanced tool will not be of much help if not used effectively or if not understood well.

Moodle is one of the many available online learning platforms in the world written in PHP and distributed under the GNU General Public License (Moodle, 2013). Although the number of its users keeps rising, it has a reputation of not being the most user-friendly, from both the student's and the faculty's point of view. Moodle can be used for blended learning, flipped classroom, distance education and other study-related areas in both the secondary and higher education. Rīga Stradiņš University (RSU) is one of the tens of thousands of learning environments globally that has chosen Moodle to facilitate the online learning environments of otherwise full-time and part-time studies of Medicine and Social studies.

While RSU has granted its faculty complete academic freedom, a Moodle course page is automatically created for each course each semester. The courses are created to facilitate the faculty's and the students' needs of the online learning resource – a place where study materials can be shared, tests and assignments submitted and graded, and the overall commune of the course participants created. Rīga Stradiņš University also provides face to face training for faculty and other non-faculty course creators to ensure that high-quality content is provided, using not only face to face classes but also within the Moodle courses.

After every semester, all students of RSU are asked to fill out a voluntary survey (Appendix A) to find out their satisfaction with each separate course they had. The anonymous results of these surveys are then presented to the corresponding faculty of the course and the corresponding head of the department. Faculty then can take into account the survey results and comments (if there are any) to improve their courses according to the students' reviews.

So far, no general in-depth analysis has ever been done regarding the reviews, the actual courses, and their e-environments to find any correlation between the quality of the course and the students' reviews. This study will provide an analysis of e-course patterns and links

between these e-courses and student satisfaction reviews will show aspects that have a vital role in engaging and motivating a student that then leads to a well-rounded and satisfied student.

Analyzing the general tools of Moodle that have proven to be the best student motivators and engagers in previous research will give an overview of tools that should be used in every Moodle course to increase student satisfaction.

The following objectives were set to reach the following goals:

1. Collecting student course review data to select the courses for more in-depth analysis;
2. Analyzing the selected course Moodle environments;
3. Analyzing the selected course survey results for questions that are significant to this study;
4. Analyzing the Moodle tool use;
5. Analyze the correlations between the course Moodle environments, Moodle tools used and the course survey results.

1.1. Technology

“Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments.” (About Moodle, 2018) Moodle is also customizable with the option of adding additional plugins to the default version.

A Rīga Stradiņš University administrator who facilitates the environment’s usage to the target audience and users of the system – RSU students and faculty, has modified the platform. The platform is available to all Rīga Stradiņš University students and the faculty. Before every study semester, Moodle is synchronized with the RSU Study Information System to automatically create all the necessary course pages with moderator access to the courses for the faculty and their assisting staff (if required), as well as student groups for each course. This way nor the faculty nor students have to worry about being added to their courses – it is done automatically.

While the faculty has full academic freedom, they are asked to use the Moodle environment as the online environment of their courses. However, this does not mean that the entire faculty use the environment, or use it at the highest quality.

1.2. Theoretical Background

1.2.1. The Importance of Online Learning Management System Moodle.

Multiple studies (Sife, Lwoga, & Sanga, 2007; Demiray, 2011) have stressed the importance of e-learning and its tools for improving the study process in higher education. While there are multiple existing online learning management systems available (e.g., Blackboard Learn¹, Moodle, WebCT²), 94210 educational institutions from 230 countries all over the World have chosen Moodle as their learning management system (Registered Moodle sites, n.d.).

Moodle is the learning management system that is mandatory for all faculty of Rīga Stradiņš University (RSU), offering an average of more than 800 courses yearly to approximately 8,000 students at the same time.

Capterra, the World's leading digital marketplace for business software ranked Moodle in the first place by total users in November 2017 (The Top 20 Most Popular LMS Software). While Moodle is not in the first place by the most user-friendly software, its large community has always been an advantage for new Moodle users and partner universities. Moodle's large variety of possible functions, plugins and tools continuously attract new universities when choosing the online learning management system of their university.

According to the approach of Piotrowski (Piotrowski, 2009), an e-learning platform represents a system that provides integrated support for six different activities: creation, organization, delivery, communication, collaboration and assessment. A study carried out at the University of Aveiro (Portugal) (Costa, Alvelos, & Teixeira, 2012) has used the Piotrowski approach to define the default available activities and modules of the Moodle platform (Table 1).

¹ Blackboard Learn – Blackboard Learn is a virtual learning environment and course management system developed by Blackboard Inc (Wikipedia, 2018)

² WebCT – WebCT or Blackboard Learning System, now owned by Blackboard, is an online proprietary virtual learning environment system that is licensed to colleges and other institutions and used in many campuses for e-learning (WebCT, 2017)

Table 1. Default available activities of the Moodle platform.

Activity	Module	Description
Creation	Database	Allows to build, display and search a bank of record entries about any topic; allows to share a collection of data
Organization	Lessons	Represent a set of ordered topics summarizing the instructional materials and allow the access to them through the respective link
Delivery	Assignments	Allow teachers to collect work from students; allow teachers to evaluate the student's work and provide feedback including grades, in a private mode; allow students to upload assignment files
	Workshops	Represent a peer assessment activity with many options; allow students to submit their work via an online text tool and attachments
Communication	Chats	Allow synchronous conversation
	Forums	Represent a communication tool where students and teachers can exchange ideas by posting comments
	News	Represent a special forum for general announcements; allow teachers to add posts and to send emails
Collaboration	Glossary	Allows creating and maintaining a list of definitions; represents a mechanism for collaborative activities that can be restricted to entries made by the teacher
	Wikis	Allow users to edit collaborative Web pages; provide space for collaborative work
Assessment	Choice	Allows teachers to ask questions and specify multiple choice answers; represents a useful mechanism to stimulate thinking about a topic
	Quiz	Allows teachers to design and build quizzes with a variety of questions, with different types of answers, such as multiple choice, true/false, short answer
	Survey	Allows teachers to gather feedback from students using prepackaged questionnaires
	Feedback	Allows teachers to gather feedback from students using prepackaged questionnaires
Reusability*	SCORM	Represent specifications that enable interoperability, accessibility and reusability of the learning content; represent tools that enable SCORM packages to be included in the course
	External tools	Enable interaction with compliant learning resources (e.g. Learning Tools Interoperability) and activities on other Web sites; provide access to new activities' types or materials

*a term not used in the classification by Piotrowski

All of the tools in Table 1 are available to all e-course pages at RSU and are suggested to use in the study process. However, since Moodle offers extended tools and additional plugins that every educational institute can add to their Moodle system, few tools are not mentioned in Table 1, but are part of Rīga Stradiņš University's Moodle system:

- JMOL filter – allows embedding of interactive 3D chemical structures (Moodle, n.d.);
- Turnitin – A comprehensive solution for grading assignments, preventing plagiarism, and safeguarding your institution's reputation. (Turnitin for Higher Education, 2018);
- Attendance plugin – “a plugin that allows an attendance log to be kept. – includes an optional block for easy access to relevant functions” (Moodle, n.d.).

Since Moodle also offers data analytics tools that can be used for analyzing student habits when using Moodle and their correlation with the grades, satisfaction rate, and other

data, it is also possible to receive data that shows the most popular activities that are used by the students (number of use).

According to the statistical data provided by Rīga Stradiņš University Moodle system, the most popular activities are shown in Table 2. However, since the system does not differentiate between Latvian and English courses, this data depicts the usage of both the Latvian and English pages of the equivalent course.

Table 2. Most used activities and resources on Moodle courses per course participant.

	Core	Resource	Quiz	Assignment	URL	Page	Folder	Turnitin	Choice	Assignment submission	Gallery	Forum	Feedback	Book	Workshop
Click per course student	158.04	127.30	21.25	15.77	11.76	8.52	7.39	4.41	4.28	3.71	.76	.46	.14	.01	.00
Percentage from total clicks	.39	.32	.05	.04	.03	.02	.02	.01	.01	.01	.00	.00	.00	.00	.00

The data in Table 2 depicts Moodle environment tools and resources that were used at least once per a course during the study period and does not depict tools or modules that were available to the course creator and user, but were not used. It is clearly seen that the most popular usage of the Moodle environment was to access the online course start page (Core). And although this number unequivocally should be the highest, (12%) courses were accessed by less than 100% of the students attending the course, meaning – not all students accessed particular course e-environments. This number was especially low for 10 (8%) courses where even less than 50% of the students taking the course accessed the course e-environment, showing the lack of motivation to even use the e-environment providing by their faculty. The lowest attended e-course reached only 8% of its target students. These numbers show an alarming situation where students lack motivation to even try and use the materials offered on their course e-environments. Therefore, this brings up a question whether it is due to a personal demotivation towards studies, not affected by the study quality, or there is a deeper problem connected to overall misuse of Moodle environment that creates the lack of motivation of using the environment in further studies. This is an aspect worth being studied in further, deeper research.

1.2.2. Instructional Design Principles.

A study carried out at Athabasca University Canada (Elias, 2010), research design principles for Moodle courses and from analyzing significant Moodle course design resources, generated 40 categories of online course accessibility for students called Universal Instructional Design Principles and Categories of Online Course Accessibility (

Table 3). These categories are noted as being essential and the most valuable when creating a motivating course for students.

Table 3. UID principle categories of online course accessibility.

UID Principle	Categories of online course accessibility
Equitable use	1. All content online 2. “Anywhere Anytime” 3. Translator
Flexible use	4. Mind maps/diagram displays 5. Conferencing tools 6. Video/audio presentation tools 7. Slide presentation tools 8. Video/audio assignment tools 9. Links to additional information 10. Choice of study topics/assignments
Simple and intuitive use	11. Resume course 12. Simple interface 13. Direct link to new posts 14. Easy-to-navigate menus 15. Books 16. Searchable forums 17. Searchable content 18. Mobile interface 19. Text-only interface 20. Offline resources
Perceptible information	21. Screen preferences, font size, masking, colors 22. Screen/document readers 23. Text-to-speech 24. Screen/cursor magnifiers 25. Transcription 26. Captions
Tolerance for user error	27. Ability to edit after posting 28. Confirmation before sending assignments 29. Warnings when leaving course site
Technical physical effort	30. Voice recognition 31. Word prediction 32. Built-in assistive technologies 33. Limited use of external links 34. Embedded multimedia / assistive technologies 35. Browser capability checker
Learner community and support	36. Study group 37. Links to support services
Instructional climate	38. Involvement in discussion forums 39. Regular e-mail contact with students 40. Availability for one-on-one consultation

As the Universal Instructional Design Principles and Categories of Online Course Accessibility (Elias, 2010) suggest, the technical design and approachability of the online

setting creates a high-quality course. As it is seen from the “Instructional climate” part of the suggestions, the course facilitator must not only be involved in discussion forums, but also maintain regular e-mail contact with students and be available for one-on-one consultation.

Although it is a common practice for the teacher to be a teacher in a classroom setting and only a course creator in the online environment, the course manager should combine both these roles in the online course setting, since it is proven to create a motivating online course for the students (Elias, 2010). In an institution like RSU where most faculty are specialists, working in their specialties, e.g., medical specialists, it is difficult for the faculty to manage such one-on-one communication with their students. Therefore such communication is often omitted leaving the students only the option of communicating within the in-class setting. However, Moodle tools could be a great help for such communication, if only wanted to be used by the course manager.

1.2.3. Learning Communities in Open Source Management Systems.

A PhD project carried out at Curtin University of Technology, Australia (Dougiamas & Taylor, 2003) applied social constructivism and connected knowing theoretical approaches to analyzing the university’s online classes and the growing community of Moodle. While in 2003 (time of research), Moodle had already been translated to 27 languages and used in many hundreds of education institutions around the world, in 2018 Moodle is offering over 100 language packs and used in more than 230 countries (Moodle Statistics, 2018). The project aimed to find out “what web structures and interfaces encourage or hinder participants engagement in reflective dialogue within a community of learners” (p. 1) since it is proven that communication tools in an Online learning management system are the critical means for increasing student engagement and motivation.

The authors (Dougiamas & Taylor, 2003) came up with Moodle guidelines that facilitate meaningful communication and student motivation from the course creator’s part. This was accomplished by applying social constructivism and connected knowing theoretical approaches towards creating an online course that would facilitate meaningful dialogue among the participants of the course and the tutors for two consecutive years (and improving the course after analyzing the first year). The guidelines are:

- I release software "early and often" (Raymond, 1999) so that even non-developer users can feel more a part of the development process and new bugs can be caught more quickly;

- I respond to email and forum posts as quickly as I can. Not only does it help encourage people to communicate, it gives more life to the site as it's always changing with new content;
- I try to be as friendly and helpful as possible at all times, even when it's tempting to flame someone. Negative posts become a permanent part of the site and can dampen further interaction between people;
- I try to be particularly supportive to contributors. With encouragement, some people can blossom. If their interest is stimulated, some people feel more able to make larger contributions;
- I continually evaluate the learning environment and make changes as necessary, evolving in a way that brings the user along on an adventure;
- I look for links and publish them (e.g. between discussions, or finding people who could help each other, or to websites/resources). As the site and community grows, this reduces the distances people have to travel to connect with the information they are looking for.

The research paper takeaways confirm that the course creator and the course facilitator must be fully involved in managing the course (not function only in the role of creating the course). The course facilitator must also communicate with the participants frequently and meaningfully in a friendly and helpful tone, highly support contributors of the course, and continuously improve and update the course page even throughout the course.

1.2.4. Students' Perspective towards Online Learning Management Systems.

A study (Damnjanovic, Jednak, & Mijatovic, 2013) done in 2013 analyzed survey results among 255 Moodle users from higher education institutions in Serbia, Lithuania and Bosnia and Herzegovina. The research results suggest, "Communication has the strongest effect on the students' perceived performance of Moodle as an e-learning management system" – which is frequently the area that is overlooked from the course creator and managers side.

The author of this study has discussed Moodle environment with students of various universities. The feeling that is communicated most often is that the students do remember Moodle as an e-study system used in their studies, but that they always found it too complicated and useless – since it was only used when the students had to submit tasks to the teacher of the course. There are still many occasions where students do not see Moodle as a supportive tool from their perspective. Moreover, although the environment is built in the way that should facilitate student participation and motivation to participate, a common practice is

to misuse Moodle in a way that the students find it just as an impractical tool they are forced to use at their university.

This perception of the online learning system might also be caused by the different perceptions of technology for both parties – the students and the academic staff. For example, North-Samardzic and Jiang (Acceptance and Use of Moodle, 2015) argue that “academic staff are more concerned with ‘institutional issues and pedagogical applications of technologies’ whereas students saw technology as a means to communicate with teachers as well as providing a means of controlling their own learning” (p. 2). This shows that the lack of student satisfaction when it comes to Moodle course usage could be cultivated based on the different expectations of the medium. While students expect to see a medium that would promote further and self-motivated learning, facilitated by a teacher, the latter one sees the online course medium as a place where to store static materials for further “silent” independent reading without any contribution from their part.

The study (North-Samardzic & Jiang, 2015, p. 11) also concludes, “It is likely that students regard Moodle as important if their professors also place importance on the technology.” Therefore acknowledging the fact that the student perception that will also create an impact on their satisfaction can be affected both ways, depending on the emphasis that the course facilitator will put on the course medium itself. Consequently, the more significant emphasis the faculty will put on the quality of the online course, the more likely it is for the student to see the online course as a significant and valuable part of their studies.

Seeing that the course facilitator can act as the main motivator of effective use of Moodle, faculty and course creators should work even harder to make sure their students are motivated and use the medium to improve their study process even more.

1.2.5. Student Satisfaction in Correlation with Moodle Data.

The Croatian Operational Research Society published a research paper that investigated a possible connection between student satisfaction with their courses and log data from a virtual learning environment (Đurđević Babić, 2015). The data of 154 students, participating in the study, was analyzed using 12 different input variables. The results confirmed, “There is a connection between student activities in an LMS course and their level of course satisfaction” (pp. 115). Therefore, it is possible to predict possible student satisfaction while the course is still ongoing, and from this data, it is possible to change the course content, so that the participation, therefore the satisfaction would raise altogether.

Research results also proved that “student engagement in forum discussions as one of the basic activity predictors of student satisfaction with courses” (pp. 115). The predictors appear even when analyzing the data using different research methods: MLP³ neural networks, RBF⁴ neural networks and classification tree models. This is a valuable insight that once again proves that creating and moderating meaningful discussions in forums, available on the Moodle platform, is a crucial element not only for student participation and self-guided learning but also for raising student satisfaction with a course in general.

1.2.6. Aims of the Study and Research Questions

The aim of the study is to find out correlations between student satisfaction and Moodle environment of their courses and to create guidelines for developing a high quality e-learning environment that would increase overall student satisfaction with their courses.

The research question to be answered is what are the correlations between student satisfaction data and the e-course environment usage of the course facilitator; how understanding these correlations can help develop a meaningful and motivating e-course environment.

³ A multilayer perceptron (MLP) is a feedforward artificial neural network that generates a set of outputs from a set of inputs. An MLP is characterized by several layers of input nodes connected as a directed graph between the input and output layers. MLP uses backpropagation for training the network. MLP is a deep learning method. (techopedia, n.d.)

⁴ Radial basis functions (RBL) are means to approximate multivariable (also called multivariate) functions by linear combinations of terms based on a single univariate function (the radial basis function). (Buhmann, 2015)

2. Methods

2.1. Participants

Student course evaluation survey data as well as the course online environments was collected from the study course evaluation surveys and the Moodle LMS online e-courses that took place in the first semester (fall) of 2017/2018 study year at Rīga Stradiņš University.

Each semester all the students are automatically synchronized from RSU Student Information System into the corresponding courses and groups. The online courses and the corresponding faculty are also synchronized automatically using the necessary information from the Student Information System. At the beginning of the study semester, 834 courses were started, and corresponding 834 e-courses were created on the e-study environment Moodle. These courses include both focus areas of Rīga Stradiņš University: Health Care and Medicine, and Social Sciences, covering 68 different study programmes in 10 faculties consisting of 42 study departments.

Since the study course evaluation surveys are provided to all the active students (at the end of the semester – 7808 students) of the specific semester, overall 41,337 surveys (26,062 (63%) of students studying in Latvian and 15,275 (37%) of students studying in English) were sent out to all students taking courses in the 2017/2018 Fall semester in 39 out of 42 (93%) Departments at Rīga Stradiņš University. Out of the 41,337 surveys sent, 11,898 (26%) surveys were completed (8,638 (73%) in Latvian and 3,260 (27%) in English).

Data for analysis was used from surveys with the completion rate of at least 40% and 10 participants completing the survey for the respective course, resulting in a total of 5,076 survey results (4,526 (89%) in Latvian and 550 (11%) in English).

Based on the selected survey results, 129 courses (119 (92%) in Latvian and 10 (8%) in English) on RSU's Moodle environment met the set requirements. Since the number of courses in English is so low, only Latvian courses were included in the analysis – therefore, a total of 119 courses and their student surveys were analyzed for the purpose of this study.

The Study course evaluation surveys are voluntary surveys (Appendix A) sent to all Rīga Stradiņš University students to evaluate their study courses. The surveys consist of 18 questions split into four sections:

1. Content of the study course and course materials;
2. The course teacher
3. Organization of the study process and learning environment;
4. Other/additional questions.

The following three (out of 18) questions were taken into account when analyzing the correlations between the study course evaluation surveys and the study course online environments:

1. The course content was topical and modern;
2. Information and study materials available on e-learning environment were sufficient, and they contributed to the acquisition of the study course;
3. The average number of hours per week, which I spent to acquire this study, course independently.

The students who complete the surveys are informed that the anonymous results of their surveys will be used to improve the quality and content of the courses. The Dean's Council of RSU has approved the usage of the survey data for the purpose of this study and for using the results to improve the quality of the courses.

2.2. Materials and Procedure

After selecting the data to process, based on the criteria described in the previous chapter, the data was processed by assigning the following values to the following types of student survey answers:

- “The course content was topical and modern” and “Information and study materials available on e-learning environment were sufficient, and they contributed to the acquisition of the study course” was coded on a 4-point scale, where 1 is completely disagree, 2 is mostly disagree, 3 is mostly agree and 4 is completely agree;
- “The average number of hours per week, which I spent to acquire this study, course independently” was coded on a 5-point scale, where 1 is less than 1 hour, 2 is 1-2 hours, 3 is 3-4 hours, 4 is 5-10 hours, and 5 is 11 and more hours.

The total value of received based on the 4 and 5-point scale was divided by the total number of students answering the specific survey to receive a value to use in further analysis.

To analyze the Moodle course environments for the specific courses, basic 27 activity and source types were defined (Table 4).

Table 4. Moodle environment activities.

Activities		Resources	File resources
1.	Survey	15. Book	21. MS Word file
2.	External tool	16. Folder	22. MS Excel file
3.	Feedback	17. IMS content page	23. MS PowerPoint file
4.	Database	18. Label	24. PDF file
5.	Forum	19. Page	25. Image file
6.	Choice	20. URL	26. Audio file

7. Lesson	27. Video file
8. Workshop	
9. Chat	
10. Quiz	
11. Turnitin assignment	
12. Assignment	
13. Glossary	
14. Wiki	

These activities and source types were chosen, based on the available activities and sources to the e-study course administrators and the appropriate academic personnel. For each activity or resource type used in the specific Moodle course environment, value 1 was assigned. The total number of activities and/or courses was divided by the number of total possible activity/resource tools to receive a value to use in further analysis.

To see whether the activities are used by students, total click statistics of Moodle tools was used. To better understand these clicks, the total clicks per every Moodle tool per every analyzed course was divided by the number of students taking the course on the corresponding semester.

2.3. Data Analysis

After data pre-processing, a correlation analysis based on Pearson's correlation coefficient was run to define the correlation between the e-study environment and the three survey result questions defined previously.

2.3.1. Limitations of the Study.

Data, regarding both student surveys and the total number of students, are exported from the RSU study information system at the end of the semester. Therefore it is possible that the total number of students within the course was different than it is at the end of a semester.

The data source offering information regarding the total usage of a tool or activity on Moodle does not differentiate between the Latvian and English courses for the same study courses. Therefore the total clicks of this data also include the Moodle usage of international students, although only study courses in Latvian are analyzed.

Since previously designed student surveys were used, only questions close to the intended study were used for analysis. For further research, it would be necessary to create a survey that would include more detailed questions regarding the Moodle system to receive higher quality results.

Since the total number of courses offered for the analyzed study semester was too significant for doing a detailed analysis, only 119 courses, corresponding to the criteria, were

analyzed. For further research or general course development purpose it would be essential to analyze all courses.

3. Results

Similarly to Conijn et al.'s research (Predicting Student Performance from LMS Data: A Comparison of 17 Blended Courses Using Moodle LMS, 2016), the Pearson Correlation Coefficient (Table 5) was used to measure the correlation between the analyzed data of all 119 courses.

Table 5. Descriptive statistics and correlation matrix for study variables.

	N	M	SD	1	2	3	4	5	6	7
1	117	3.467	.579	1						
2	119	3.324	.528	.290*	1					
3	119	2.525	.830	.016	.354*	1				
4	119	.348	.602	.089	.046	.062	1			
5	119	2.426	1.250	.161***	-.033	-.056	.218**	1		
6	119	1.346	.735	.169***	-.007	-.019	.603*	.910*	1	
7	119	317	973	.137	.104	.080	.015	-.047	-.032	1

Note. *The result is significant at the .01 level (two-tailed). **Correlation is significant at the .05 level (two-tailed). ***The results are discussed in the following order: Course content was topical and up-to-date [1]; Available information and study materials on e-learning environment were sufficient, and contributed to the acquisition of the study course [2]; The average number of hours per week which I spend to acquire this study course independently [3]; Moodle activity tools [4], Moodle resource tools, and both combined [6], Total clicks per Moodle course [7].

Pearson correlation analysis for all analyzed courses combined showed that seven of the 21 calculated coefficients had a statistically significant correlation.

3.1. General Course Satisfaction

Results of the “Course content was topical and up-to-date” showed a strong correlation when compared with the results of “Available information and study materials on e-learning environment were sufficient, and contributed to the acquisition of the study course” results ($r = .290$, $p < .001$). The correlation data, while not always equable shows that there is a meaningful correlation between the course content in general. The information and study materials available to students on the corresponding course e-environment affect the overall satisfaction with the course. And although the content of the Moodle pages can be strongly affected by the course content in general, the Moodle environment should still take an active part of the whole course process to facilitate student self-involvement in not only student

satisfaction with their courses. Of course, it is also not correct to evaluate the course only based on its e-environment, especially if the specific course is more practical rather than theoretical. However, practice is always in one way or another based on theory; therefore theoretical materials for further reading should still be included in every course's e-environment in the form of a resource file or activity.

Results of the "Course content was topical and up-to-date" also showed a significant correlation when compared to the average number of resource tools ($r = .161, p < .010$) and the total number of activity and resource tools combined used in a Moodle course ($r = .169, p < .010$). These results are strongly connected with the overall Moodle environment satisfaction of a course since the activities and resources used on Moodle were the basis of student survey evaluation question "Available information and study materials on e-learning environment were sufficient, and contributed to the acquisition of the study course". Therefore, it can be assumed that the more meaningful and valuable resources are strategically added to a course's Moodle page, the higher the students will evaluate the specific course both in the point of view of the Moodle satisfaction survey question and the overall satisfaction of the course.

Most of the lowest rated courses had no activities on the course Moodle page showing a strong correlation between the lowest-scored courses and the lack of activities on the course Moodle pages.

However, it is essential to take into account that this question looks at every aspect of the course, and not only the Moodle environment of the course

The discussed correlations of all courses collated with the overall course satisfaction results can be seen in Table 6.

Table 6. Overall course satisfaction vs Moodle satisfaction and number of Moodle resources.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Calculated course satisfaction value	4.000	4.000	4.000	4.000	4.000	4.000	3.952	3.947	3.929	3.929	3.928	3.909	3.900	3.889	3.885	3.833	3.821
2 Calculated Moodle satisfaction value	3.909	3.929	4.000	4.000	4.000	3.417	3.810	3.842	3.786	3.571	3.897	3.818	3.800	3.667	3.703	3.667	3.429
3 Moodle resource tool average	.385	.231	.231	.154	.308	.154	.462	.308	.231	.308	.385	.154	.231	.000	.000	.154	.154
4 Moodle resource and activity tool average	.185	.111	.148	.074	.148	.111	.296	.148	.185	.222	.222	.111	.111	.000	.074	.074	.074
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1 Calculated course satisfaction value	3.818	3.818	3.818	3.818	3.813	3.810	3.800	3.800	3.798	3.790	3.786	3.786	3.784	3.778	3.774	3.773	3.765
2 Calculated Moodle satisfaction value	3.864	3.818	3.364	3.636	3.750	3.620	3.600	3.900	3.595	2.900	3.571	3.214	3.892	3.833	3.065	3.318	3.618
3 Moodle resource tool average	.077	.077	.000	.231	.462	.385	.231	.231	.231	.308	.231	.000	.308	.308	.231	.308	.308
4 Moodle resource and activity tool average	.037	.037	.000	.111	.222	.222	.111	.148	.111	.148	.148	.000	.222	.222	.111	.148	.185
	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1 Calculated course satisfaction value	3.765	3.762	3.754	3.750	3.747	3.727	3.727	3.727	3.727	3.727	3.727	3.722	3.714	3.700	3.700	3.693	3.692
2 Calculated Moodle satisfaction value	3.706	3.619	3.638	3.667	3.620	3.682	3.273	3.455	3.909	2.727	2.818	3.778	3.557	2.900	3.700	3.737	3.000
3 Moodle resource tool average	.308	.308	.385	.231	.231	.154	.154	.000	.231	.154	.308	.308	.308	.231	.231	.077	.385
4 Moodle resource and activity tool average	.185	.148	.185	.111	.148	.074	.111	.000	.111	.074	.148	.148	.148	.111	.111	.037	.185
	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
1 Calculated course satisfaction value	3.688	3.688	3.676	3.667	3.657	3.651	3.647	3.638	3.628	3.625	3.600	3.588	3.580	3.579	3.536	3.522	3.519
2 Calculated Moodle satisfaction value	2.978	3.813	3.162	3.800	3.400	2.279	3.706	3.313	3.667	3.508	3.600	3.059	2.744	3.342	2.107	3.217	3.815
3 Moodle resource tool average	.077	.308	.231	.462	.385	.231	.231	.308	.538	.308	.615	.308	.154	.000	.462	.231	.231
4 Moodle resource and activity tool average	.037	.185	.148	.222	.259	.111	.111	.148	.259	.148	.296	.148	.148	.037	.222	.111	.111
	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
1 Calculated course satisfaction value	3.500	3.500	3.500	3.488	3.462	3.458	3.455	3.447	3.444	3.438	3.429	3.400	3.388	3.385	3.375	3.375	3.342
2 Calculated Moodle satisfaction value	3.714	3.750	3.667	3.547	3.385	3.125	3.591	3.763	3.389	3.152	2.257	3.000	2.898	3.231	3.292	3.042	3.152
3 Moodle resource tool average	.231	.308	.308	.231	.077	.385	.231	.231	.231	.154	.308	.154	.231	.231	.308	.385	.308
4 Moodle resource and activity tool average	.111	.185	.333	.111	.037	.259	.111	.111	.111	.074	.148	.148	.111	.111	.148	.259	.222

	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
1 Calculated course satisfaction value	3.327	3.300	3.292	3.286	3.278	3.267	3.263	3.250	3.211	3.200	3.200	3.182	3.163	3.143	3.100	3.091	3.042
2 Calculated Moodle satisfaction value	2.809	3.000	2.917	3.810	2.167	2.267	3.316	2.833	3.211	2.200	2.600	3.364	3.512	3.429	3.100	3.182	2.333
3 Moodle resource tool average	.154	.615	.462	.308	.231	.308	.000	.077	.154	.385	.231	.000	.154	.308	.231	.231	.308
4 Moodle resource and activity tool average	.074	.370	.222	.185	.111	.185	.000	.037	.074	.259	.111	.000	.074	.148	.111	.185	.148
	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117		
1 Calculated course satisfaction value	3.000	2.952	2.939	2.929	2.867	2.857	2.833	2.800	2.769	2.714	2.710	2.583	2.347	.000	.000		
2 Calculated Moodle satisfaction value	2.429	1.857	2.970	4.000	2.400	2.500	3.708	2.900	3.077	2.643	3.364	2.167	1.573	3.538	3.941		
3 Moodle resource tool average	.385	.231	.231	.308	.077	.308	.077	.231	.077	.154	.308	.231	.231	.154	.000		
4 Moodle resource and activity tool average	.259	.111	.111	.148	.037	.148	.037	.111	.037	.074	.185	.111	.148	.074	.000		

Note. Numbers 1 through 117 represent each course that was analyzed within the study. The courses are numbered based on the highest value of the overall course satisfaction result.

3.2. Moodle Course Environment Satisfaction

Results of the “Available information and study materials on e-learning environment were sufficient, and contributed to the acquisition of the study course” showed a strong correlation when compared with the results of “The average number of hours per week which I spend to acquire this study course independently” results ($r = .354$, $p < .001$).

An even higher correlation is seen between the Moodle content satisfaction and the average time a student spends to acquire the study course independently per week. This only proves that if the content is provided, the student will spend more time acquiring the course. Unfortunately, spending more time on acquiring study materials does not always mean that this time is spent wisely. The number of hours spent on acquiring the course could mean both that there was plenty of further reading materials available on Moodle and that the course activities required more time for completing. However, if further research was done to analyze the time spent on acquiring the course (e.g. time spent on Moodle activities and the final student result on the course), it could give a definite answer regarding the importance of this correlation. At this point aspects affecting these results and this correlation are too broad to make a definite conclusion.

Correlations of all courses collated with the overall Moodle satisfaction results and time spent on independent studies can be seen in Table 7.

Table 7. Moodle satisfaction vs time spent on independent studies.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Calculated Moodle satisfaction value	4.000	4.000	4.000	4.000	3.941	3.929	3.909	3.909	3.900	3.897	3.892	3.864	3.842	3.833	3.818	3.818	3.815
2 Time spent on independent studies	3.929	3.529	3.091	1.714	2.412	3.429	1.545	1.455	2.600	3.289	3.000	1.955	2.211	4.389	2.545	1.727	1.296
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1 Calculated Moodle satisfaction value	3.813	3.810	3.810	3.800	3.800	3.800	3.786	3.778	3.763	3.750	3.750	3.737	3.714	3.708	3.706	3.706	3.703
2 Time spent on independent studies	3.688	3.810	3.810	3.133	2.600	2.500	2.429	2.611	2.763	2.250	1.875	3.898	1.843	2.292	3.647	3.235	1.697
	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1 Calculated Moodle satisfaction value	3.700	3.682	3.667	3.667	3.667	3.667	3.667	3.638	3.636	3.620	3.620	3.619	3.618	3.600	3.600	3.595	3.591
2 Time spent on independent studies	2.800	2.591	3.389	3.250	3.062	2.583	2.556	1.681	2.091	3.297	3.521	3.524	2.824	2.700	1.100	3.736	2.909
	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
1 Calculated Moodle satisfaction value	3.571	3.571	3.557	3.547	3.538	3.524	3.512	3.508	3.455	3.429	3.429	3.417	3.400	3.389	3.385	3.364	3.364
2 Time spent on independent studies	3.214	1.929	3.614	3.198	4.231	1.476	1.791	3.313	2.364	2.857	2.190	2.333	2.457	2.056	2.846	2.346	3.955
	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
1 Calculated Moodle satisfaction value	3.364	3.342	3.318	3.316	3.313	3.292	3.273	3.231	3.217	3.214	3.211	3.182	3.162	3.152	3.152	3.125	3.100
2 Time spent on independent studies	2.636	3.921	3.500	1.421	1.613	2.917	1.909	3.231	3.609	1.929	2.316	3.545	2.838	3.667	2.000	1.833	1.700
	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
1 Calculated Moodle satisfaction value	3.077	3.065	3.059	3.042	3.000	3.000	3.000	2.978	2.970	2.917	2.900	2.900	2.900	2.898	2.833	2.818	2.809
2 Time spent on independent studies	2.077	.871	2.176	2.417	3.308	2.000	1.800	2.806	2.030	1.875	2.640	2.200	1.900	2.357	3.417	1.545	.704
	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
1 Calculated Moodle satisfaction value	2.744	2.727	2.643	2.600	2.500	2.429	2.400	2.333	2.279	2.267	2.257	2.200	2.167	2.167	2.107	1.857	1.573
2 Time spent on independent studies	2.441	2.909	3.214	2.100	1.571	1.429	2.133	1.167	.907	1.067	3.486	1.200	1.000	2.833	2.321	2.381	1.627

Note. Numbers 1 through 119 represent each course that was analyzed within the study. The courses are numbered based on the highest value of the overall Moodle satisfaction result.

3.3. The Average Time Spent on Independent Studies Weekly

Results of the “The average number of hours per week which I spend to acquire this study course independently” did not show any strong correlation other than the one mentioned in the previous chapter.

3.4. Activity and Resource Tools on Moodle

The number of activity tools used on Moodle showed a meaningful correlation with the number resource tools used on the Moodle course ($r = .218$, $p < .005$).

Although there were not many courses that used Moodle activity tools in their e-environments, it did show a meaningful correlation when compared with the resources used in the courses. This correlation shows that the more activity tools are used within a course, the fuller the course will be with resource tools as well. Moreover, as the previous correlations show, use of course resources strongly affect the overall satisfaction with the course.

Out of 27 different possible activity and resource options on Moodle, the highest number of used activities and resources combined is 10 [1] for only one course out of the 119 analyzed courses (less than 1%). Seven out of 119 courses (6%) did not have any information on their Moodle page. Only 37 out of 119 (31%) courses used at least one type of activity on their Moodle page. The rest choose to post only resources or nothing on their Moodle pages. However, there are only two courses [18] [37] that only had activities (two and three types) shared with their students and no files or documents on the Moodle page.

This data clearly shows the inconsistency through a single university regarding the use of the same resource (Moodle). As it was mentioned in the Theoretical Background section, there are Moodle training offered to all interested faculty and course creators within the university that could help improve the overall quality of the courses, but sadly, these training events are not widely visited. It also showed a strong correlation with the total number of activity and resource tools used on a Moodle course, but since activity use was included in this total result, this correlation is not significant for the current study.

Correlations of all courses collated with the overall Moodle satisfaction results and time spent on independent studies can be seen in Table 8.

Table 8. Moodle activities vs resources.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Moodle activity tool average	.357	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143	.143
2 Moodle resource tool average	.308	.615	.462	.385	.385	.385	.385	.385	.308	.308	.308	.308	.231	.231	.231	.154	.154
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1 Moodle activity tool average	.143	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071	.071
2 Moodle resource tool average	.000	.385	.385	.308	.308	.308	.308	.308	.308	.308	.231	.231	.231	.231	.231	.231	.154
	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1 Moodle activity tool average	.071	.071	.071	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 Moodle resource tool average	.154	.154	.000	.615	.538	.462	.462	.462	.462	.385	.385	.385	.308	.308	.308	.308	.308
	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
1 Moodle activity tool average	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 Moodle resource tool average	.308	.308	.308	.308	.308	.308	.308	.308	.308	.308	.308	.308	.308	.231	.231	.231	.231
	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
1 Moodle activity tool average	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 Moodle resource tool average	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231	.231
	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
1 Moodle activity tool average	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 Moodle resource tool average	.231	.231	.231	.231	.231	.231	.231	.154	.154	.154	.154	.154	.154	.154	.154	.154	.154
	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
1 Moodle activity tool average	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 Moodle resource tool average	.154	.077	.077	.077	.077	.077	.077	.077	.077	.077	.000	.000	.000	.000	.000	.000	.000

Note. Numbers 1 through 119 represent each course that was analyzed within the study. The courses are numbered based on the highest value of the Moodle activity tool result.

3.5. Total Clicks of Moodle Activities and Resources

No significant correlation was found when comparing the average number of Moodle activity and resource tools used on Moodle and the other data resources analyzed in this study.

However, as it was discussed in chapter 1.2.1, only a few of the possible activity and resource tools were used both by the faculty and their students during the study semester analyzed in this research. Moreover, data in Table 2. Most used activities and resources on Moodle courses per course participant clearly shows how rarely tools that motivate and engage the students the most are used.

3.6. Highest Valued Course Characteristics

Although the analysis results did not present an unequivocal pattern for highest rated courses based on different values, the used activity and resource tool patterns in the courses are very similar. Based on all the different aspects of this study, the following six courses could be defined as the highest scored based on the following categories:

- Overall course satisfaction (Course 6 in Table 9);
- Overall Moodle satisfaction (Course 4 in Table 9);
- Time spent acquiring the course independently (Course 3 in Table 9);
- Number of activity tools (Course 2 in Table 9);
- Number of resource tools (Course 1 in Table 9);
- Average clicks per course (Course 5 in Table 9).

Table 9. Highest valued course characteristics vs Piotrowski's approach.

		Quiz*	Turnitin Assignment***	Feedback*	Choice*	Lesson**	Assignment***	Resources	Total
1	27	1	1					8	10
2	27	1		1	1	1	1	5	9
3	542	1	1					4	6
4	15		1					2	3
5	237							3	3
6	239							2	2
Total		6	5	3	3	3	2	24	

Note. *According to Piotrowski's approach – Assessment tools. **According to Piotrowski's approach – Delivery tools. ***According to Piotrowski's approach – Organization tools.

Activity tools that were not used in any of the top valued courses: Creation tools – Database; Delivery – Workshop; Communication – Chat, Forum, News; Collaboration – Glossary, Wiki; Assessment – Survey. Resource tools not used in any of the top valued courses: Book, Images, Audio, IMS Content Package, Label.

As it is seen in Table 9, course creator mostly focus either on Assessment tools or Organization tools. None of the courses used any Creation, Communication of Collaboration tools once again proving that even the highest rated courses do not focus on these aspects of the study process.

Table 10 depicts the popularity of the activity and resource tools that the students have used in their study process. An alarming fact is that even if an activity tool was provided, it does not mean that it was used by the student of the course (Feedback, Choice and Assignment). Moreover, although Quizzes and Turnitin Assignments were the most popular activity tools that the students used in the particular course Moodle pages, it is clear that the most popular usage of Moodle is assessing different resources shared with the student on the e-course.

Table 10. Highest valued course total clicks per activity.

		Quiz	Turnitin Assignment	Feedback	Choice	Lesson	Assignment	Resources	Total
1	27	18737	5093					22058	45888
2	27					607		1401	2008
3	542	1414	1729					1013	4156
4	15							509	509
5	237							240	240
6	239							1462	1462
Total		20151	6822	0	0	607	0	26683	

To take into account the number of students that were registered on the particular courses, Table 11 shows the same statistical data, only per student of the course. Dividing the data per student, it is clear that the results differ a bit, showing that even though the total clicks of a course seemed high, and it is not as high when divided per students (e.g. courses 3, 5 and 6).

Table 11. Highest valued course total clicks per activity per student.

		Quiz	Turnitin Assignment	Feedback	Choice	Lesson	Assignment	Resources	Total
1	27	694	188.6					817	1699.6
2	27					22.5		51.9	74.4
3	542	2.6	3.2					1.9	7.7
4	15							33.9	33.9
5	237							1	1
6	239							6.1	6.1
Total		696.6	191.8	0	0	22.5	0	911.8	

The data in Tables 8, 9 and 10 once again demonstrates that the student course data should be analyzed altogether and not by focusing on separate aspects of the courses in further studies.

4. Discussion

4.1. Piotrowski's Approach

Previously the approach of Piotrowski (Document-oriented e-learning components, 2009) was introduced as a descriptor of an online learning management system. The system supports six different activity groups: creation (database), organization (lesson), delivery (assignment, workshop), communication (chat, forum, news), collaboration (glossary, wiki) and assessment (choice, quiz, survey, feedback).

If the results of the studied Moodle course e-environment are analyzed, the following results are seen (Table 12):

- The e-course creators of the courses analyzed mostly focuses on sharing files (resources) with their students, which are not taken into account when looking at student performance and involvement by Piotrowski's approach, therefore are not considered as essential aspects when analyzing students involvement and therefore satisfaction of courses;
- The e-course creators of the analyzed RSU courses rarely used the activities (in only 4% of the analyzed courses) that Moodle offers. Furthermore, if the activities were used, they mostly chose activities that focus on delivery (assignments) and assessment (choice and quiz) and not on communication and collaboration that are still the most essential aspects in a study environment to raise the student satisfaction with their studies;
- Although a news forum is automatically included in every online course, it was rarely used. Moreover, since a news forum can be only used by the course manager and not the students, it can only encourage one-way communication instead of two-way communication between the students and the faculty. None of the analyzed courses used any activities that would promote student communication or communication with the faculty. Although it is possible that the students communicated outside the Moodle system (via e-mail or in person), the Moodle environment did not motivate any communication.
- Collaboration is another aspect that is not motivated by the activities used in the analyzed courses – nor glossaries nor wikis appeared as activities offered to the students, therefore other than group works possibly taking place during the in-class lessons, no group works, promoting collaboration were performed as well.
- The activities that the course creators focus on motivate delivery and assessment. An approach that focuses on individual homework/project creation and assessment. Choice

activity that is one of the most used activities in the assessment part, mostly discussed organizational questions (such as planning consultations and tests), instead of promoting self-guided learning or assessing one's knowledge or skills.

Table 12. Course Moodle activity division based on Piotrowski's approach.

	Activity	Number of courses using the activity	% of course total
Creation	Database	0	0%
Organization	Lesson	1	1%
Delivery	Assignment	26	22%
	Workshop	0	0%
Communication	Chat	0	0%
	Forum	0	0%
Collaboration	Glossary	0	0%
	wiki	0	0%
	Choice	14	12%
Assessment	Quiz	15	13%
	Survey	1	1%
	Feedback	1	1%
Average %			4%

Moreover, although previous research has clearly shown that communication and collaboration are the areas that promote student involvement and satisfaction with their courses, it is clear that these are not the aspects that the course creators of RSU focus on at all.

4.2. UID Principles and Categories of Online Course Accessibility

The 40 categories of online course accessibility for students, defined by the study, carried out at Athabasca University Canada (Elias, 2010), shows a different picture when used to analyze the online course accessibility for RSU students (Table 13).

Table 13. RSU online course accessibility based on UID principles.

Categories of online course accessibility		RSU correspondence with the UID principle	
Equitable use			
1.	All content online	1.	All courses have an online page, but not all of them share useful content
2.	“Anywhere Anytime”	2.	E-study content is available anywhere anytime
3.	Translator	3.	E-study content is available to Latvian students in Latvian and international students in English. However, equivalent courses in both languages might not share identical content
Flexible use			
4.	Mind maps/diagram displays	4.	Rarely used
5.	Conferencing tools	5.	Available for use to all faculty
6.	Video/audio presentation tools	6.	Available for use to all faculty
7.	Slide presentation tools	7.	Available for use to all faculty
8.	Video/audio assignment tools	8.	Available for use to all faculty
9.	Links to additional information	9.	Available for use to all faculty
10.	Choice of study topics/assignments	10.	Students have mandatory courses that they must attend and free-choice courses that they can choose from
Simple and intuitive use			
11.	Resume course	11.	The functionality is available (Lesson activity), but not used by the analyzed courses; However, the students can access the course content any time and resume their progress with the shared materials and activities
12.	Simple interface	12.	Too ambiguous to answer
13.	Direct link to new posts	13.	The students receive e-mails with direct links to new activities and deadlines on their Moodle courses
14.	Easy-to-navigate menus	14.	Available, but not frequently used
15.	Books	15.	Available to all students
16.	Searchable forums	16.	The functionality is available but was not used in any of the analyzed courses
17.	Searchable content	17.	Available to all Moodle course users
18.	Mobile interface	18.	There is no Moodle application available. However, the interface can be accessed from mobile devices, although it is not responsive
19.	Text-only interface	19.	Not available
20.	Offline resources	20.	Not possible to access the e-study environment offline
Perceptible information			
21.	Screen preferences, font size, masking, colors	21.	Full academic freedom includes the free choice of choosing the visual means of faculty’s materials
22.	Screen/document readers	22.	Available to all faculty, but not in all auditoriums
23.	Text-to-speech	23.	Not available
24.	Screen/cursor magnifiers	24.	Available to all faculty
25.	Transcription	25.	Not available
26.	Captions	26.	Available on Moodle, but not used in any of the analyzed courses
Tolerance for user error			
27.	Ability to edit after posting	27.	Available on Moodle
28.	Confirmation before sending assignments	28.	Available on Moodle
29.	Warnings when leaving course site	29.	Not available

Technical physical effort	
30. Voice recognition	30. Not available
31. Word prediction	31. Not available
32. Built-in assistive technologies	32. Not available
33. Limited use of external links	33. Use of external links is not limited
34. Embedded multimedia / assistive technologies	34. Available on Moodle
35. Browser capability checker	35. Moodle can be accessed from any internet browser. Therefore there is no need for a browser capability checker
Learner communication and support	
36. Study group	36. Students are free to create study groups
37. Links to support services	37. Available to all students
Instructional climate	
38. Involvement in discussion forums	38. Discussion forums were not used in any of the analyzed courses
39. Regular e-mail contact with students	39. The functionality is available, but it cannot be checked during the study
40. Availability for one-on-one consultation	40. Can be organized by each faculty, but cannot be checked during the study

When comparing the RSU online course accessibility based on UID principles, it is clear that Rīga Stradiņš University is at a high level when making sure the online course content is available to both its students and faculty. However, there are still some areas based on the UID principles (e.g., technical physical effort, learner communication and support) that need to be developed.

The UID principles once again signalize that learner communication and support is one of the most critical areas that is, but that should not be overlooked. After analyzing the courses and comparing the results to Pietrowski's approach as well, it is evident that this still is an area that is overlooked in RSU courses.

4.3. Learning Communities in Open Source Management Systems

In the previously mentioned PhD project, carried out at Curtin University of Technology (Dougiamas & Taylor, 2003), the study authors defined six guidelines that facilitate meaningful communication and student motivation that should be followed by the course creators.

Similarly to other aspects, looked at within the study, the six guidelines focus on promoting positive two-way communication among the students and faculty. However, as it was discussed in the previous chapters, current RSU Moodle pages do not promote any two-way communication. Therefore it is not possible to evaluate the use of these guidelines in the study process. However, these guidelines should be observed in the study process to promote student involvement, motivation and therefore – satisfaction with the course.

After comparing the RSU Moodle trends with the social constructivism and connected knowing theoretical approach guidelines, the following conclusions were made (Table 14):

Table 14. Social constructivism and connected knowing guidelines vs RSU Moodle.

Social constructivism and connected knowing theoretical approach guidelines	RSU Moodle trend correspondence to the guidelines
I release software "early and often" (Raymond, 1999) so that even non-developer users can feel more a part of the development process and new bugs can be caught more quickly;	In case of any system updates, all users are informed about any possible changes and disturbances, connected with the updates;
I respond to email and forum posts as quickly as I can. Not only does it help encourage people to communicate, it gives more life to the site as it's always changing with new content;	This aspect could not be assessed during the study, due to lack of forums and lack of information regarding student and faculty e-mail communication tendencies;
I try to be as friendly and helpful as possible at all times, even when it's tempting to flame someone. Negative posts become a permanent part of the site and can dampen further interaction between people;	This aspect could not be assessed during the study due to lack of forums, therefore – lack of positive or negative comments;
I try to be particularly supportive to contributors. With encouragement, some people can really blossom. If their interest is stimulated, some people feel more able to make larger contributions;	This aspect could not be assessed during the study due to lack of collaboration and contribution activities on the analyzed courses;
I continually evaluate the learning environment and make changes as necessary, evolving in a way that brings the user along on an adventure;	This aspect could not be assessed within the study due to lack of information regarding faculty trends of continually evaluating and improving the learning environment;
I look for links and publish them (e.g. between discussions, or finding people who could help each other, or to websites/resources). As the site and community grows, this reduces the distances people have to travel to connect with the information they are looking for.	Although links were used in the courses analyzed, the amount of usage could still be more significant, taking into account the endless amount of valuable information on the internet.

4.4. Students' Perspective Towards Online Learning Systems

It is not only the academic research that suggests that communication is the main means for technology use in their education. Research (Waycott, Bennett, Kennedy, Dalgarno, & Gray, 2010) argues that "academic staff are more concerned with 'institutional issues and pedagogical applications of technologies' whereas students saw technology as a means to communicate with teachers as well as providing a means of controlling their own learning", and it is proven by the research to be true. As it is seen in the courses analyzed, most faculty uses the Moodle environment as a tool where to store significant resources for the students, instead of promoting communication among students and their self-guided learning. The only self-guided learning that is promoted by Moodle is mostly the materials shared with the students. Therefore it is advised that the faculty and course creators assess their course e-environments and include activities and tools that would promote student and faculty two-way communication and improve student self-guided learning other than offering them reading materials.

4.5. Students Satisfaction in Correlation with Moodle Data

Durđević Babić's research that investigated the connection between student satisfaction and their courses using log data from their e-learning environment. The results proved that there is a connection between these two aspects. The results also proved that student engagement in forum discussions is one of the essential activity predictors of student satisfaction with courses (Predicting student satisfaction with courses based on log data from a virtual learning environment – a neural network and classification tree model, 2015). Therefore, if the course managers would regularly use student activity log data, available to all administrators and managers of the specific course, the faculty could then predict the student satisfaction level and change the course e-environment content to promote student motivation and therefore satisfaction. Unfortunately, this is not done with the analyzed courses of RSU, since the course content is mostly prepared before the course starts and rarely changed drastically to adapt to the specific students, their needs, and to increase their involvement and motivation with the course.

4.6. Recommendations

- Include activities promoting two-way communication and collaboration between the students and the faculty;
- Motivate students to contribute to the course by allowing them to contribute with meaningful resources and discussions via forums, databases, glossaries, and other resources. Encourage the students who contribute.
- Include activities that promote self-guided learning, e.g., quizzes, activities, discussion forums, and other activities.
- Exercise the log, and statistical data Moodle offers to predict student motivation and satisfaction with the course, and update the course accordingly.
- Manage the course, using the basic of social constructivism and connected knowing theoretical approaches.

4.6.1. Recommendations for Further Research

- To analyze the content quality of a Moodle course environment, more in-depth research, analyzing time spent on Moodle vs. received marks and student satisfaction should be done. Such analysis could confirm or deny if the time spent on Moodle signalizes a significant correlation with student satisfaction and therefore could be used as a hint for the need (or not) of updating the e-course during the course itself.

- A more in-depth analysis of student Moodle usage patterns and expectations should be done to create personalized guidelines for course creators regarding their course content on Moodle.
- A similar analysis should be done, surveying the faculty and course creators to see the reasons behind the remising use of all the tools that Moodle offer – does faculty see no point behind it; or is it lack of knowledge and/or time for doing so.

4.7. Conclusions

Even though there are still people who resist the increasing importance of technology, it is important not to resist, but to accept the fact that technology will become a more and more critical part not only the educational sector but also our everyday lives. Adapting to new (and sometimes not too new) technology will only improve the ways people are operating, especially in the education sector. By learning how to use technology, in the case of this study – Moodle, the learner will only be the winner, since by knowing and understanding the technology, it will be used more effectively and efficiently.

Even though the study has found correlations between overall student satisfaction with a course and the course content, the data is not always precise. If a course is highly assessed based on their e-course activities it does not mean that the same course will be assessed as high when analyzed from the viewpoint of its overall quality. However, there are also cases where being evaluated as the lowest course based on its overall student satisfaction and their satisfaction with Moodle, also means that the course simply had no content on its e-course (among other possible aspects).

However, a particular course that had the highest click-rate per student in the study semester analyzed, also clearly shows why that is – a course that is moderately full with significant resources will also receive plenty of visits and participation. Moreover, in this case it meant that the course was also on top 8% of the highest rated courses overall.

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Tija Briede

Author's Declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Signature:

Date:

References

- About Moodle*. (2018, March 1). Retrieved April 30, 2018, from Moodle:
https://docs.moodle.org/34/en/About_Moodle
- Buhmann, M. (2015, May 26). *Scholarpedia*. Retrieved June 4, 2018, from Radial basis function: http://www.scholarpedia.org/article/Radial_basis_function
- Conin, R., Snijders, C., Kleingeld, A., & Matzat, U. (2016, October 1). Predicting Student Performance from LMS Data: A Comparison of 17 Blended Courses Using Moodle LMS. *IEEE Transactions on Learning Technologies*, 99. Retrieved June 4, 2018, from https://www.researchgate.net/publication/309098673_Predicting_Student_Performance_from_LMS_Data_A_Comparison_of_17_Blended_Courses_Using_Moodle_LMS
- Costa, C., Alvelos, H., & Teixeira, L. (2012). The use of Moodle e-learning platform: a study in a Portuguese. *Procedia Technology*(5). Retrieved June 4, 2018, from file:///C:/Users/tijtuh/Downloads/The_Use_of_Moodle_e-learning_Platform_A_Study_in_a.pdf
- Damnjanovic, V., Jednak, S., & Mijatovic, I. (2013, May 30). *Factors affecting the effectiveness and use of Moodle: students' perception*. Retrieved January 21, 2018, from Taylor & Francis Online:
<http://www.tandfonline.com/doi/abs/10.1080/10494820.2013.789062>
- Demiray, U. (2011, April 5). *Distance education and eLearning practices - In Turkey and Eastern countries*. Retrieved February 2018, from OpenEducationEuropa:
<https://www.openeducationeuropa.eu/en/article/Distance-education-and-eLearning-practices%3A-In-Turkey-and-Eastern-countries>
- Dougiamas, M., & Taylor, P. (2003). *Moodle: Using Learning Communities to Create an Open Source Course Management System*. Retrieved January 21, 2018, from Moodle Research: <http://research.moodle.net/33/>
- Đurđević Babić, I. (2015). Predicting student satisfaction with courses based on log data from a virtual learning environment – a neural network and classification tree model. *Croatian Operational Research Review*, 6(1), 105-120. Retrieved March 10, 2018, from <https://hrcak.srce.hr/ojs/index.php/crorr/article/view/2804>
- Elias, T. (2010). *Universal Instructional Design Principles for Moodle*. Retrieved January 21, 2018, from <http://www.irrodl.org/index.php/irrodl/article/view/869>
- Moodle*. (n.d.). Retrieved June 2, 2018, from Filter: Jmol:
https://moodle.org/plugins/filter_jmol

- Moodle*. (n.d.). Retrieved June 2, 2018, from Activities: Attendance:
https://moodle.org/plugins/mod_attendance
- Moodle*. (2013, July 23). Retrieved June 4, 2018, from License:
<https://docs.moodle.org/dev/License>
- Moodle Statistics*. (2018). Retrieved March 9, 2018, from Moodle.net:
<https://moodle.net/stats/>
- North-Samardzic, A., & Jiang, B. (2015). *Acceptance and Use of Moodle by Students and Academics*. Melbourne: AMCIS. Retrieved June 4, 2018, from
 file:///C:/Users/tijtuh/Downloads/zdoc.site_acceptance-and-use-of-moodle-by-students-and%20(2).pdf
- Piotrowski, M. (2009). *Document-oriented e-learning components*. University Otto von Guericke - Magdeburg, Faculty of Computer Science. Retrieved March 12, 2018, from ResearchGate: <https://files.eric.ed.gov/fulltext/ED533734.pdf>
- Raymond, E. S. (1999). *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*. O'Reilly Media. Retrieved March 2018
- Registered Moodle sites*. (n.d.). Retrieved February 2018, from Moodle.net:
<https://moodle.net/sites/>
- Sife, A. S., Lwoga, E. T., & Sanga, C. (2007). New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 3(2), 57-67. Retrieved February 2018, from
<http://ijedict.dec.uwi.edu/viewarticle.php?id=246>
- techopedia*. (n.d.). Retrieved June 4, 2018, from Multilayer Perceptron (MLP):
<https://www.techopedia.com/definition/20879/multilayer-perceptron-mlp>
- The Top 20 Most Popular LMS Software*. (2017). Retrieved March 9, 2018, from Capterra:
<https://www.capterra.com/learning-management-system-software/#infographic>
- Turnitin for Higher Education*. (2018). Retrieved May 23, 2018, from Turnitin:
http://turnitin.com/en_us/higher-education
- Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B., & Gray, K. (2010). Digital divides? Student and staff perceptions of information and communication technologies. *Computers and Education*, 54(4), 111-117. Retrieved March 9, 2018, from
<https://dl.acm.org/citation.cfm?id=1749767>
- WebCT*. (2017, July 15). Retrieved June 5, 2018, from Wikipedia:
<https://en.wikipedia.org/wiki/WebCT>

Wikipedia. (2018, May 27). Retrieved June 5, 2018, from Blackboard Learn:

https://en.wikipedia.org/wiki/Blackboard_Learn

Appendices

Appendix 1. Student course evaluation survey example.

- Study course

evaluation (v2)

Content of the study course and course materials					
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
* The course content was topical and up-to-date	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The course content did not unnecessarily repeat the content of other courses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The study course was taught in a sequential and logical manner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* It was possible to apply theoretical knowledge acquired during the study course in practical classes and seminars at sufficient level	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* Tests and examinations corresponded with the content acquired during the study course.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* Available information and study materials on e-learning environment were sufficient, and contributed to the acquisition of the study course.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The sources indicated in the description of the study course were available and relevant to the acquisition of the content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your comments:					
<div></div>					

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
* At the beginning of the study course the lecturer presented the goal, content, expected learning outcomes, assessment criteria and type of assessment of the course.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer was prepared and fully presented the topics defined in the description of the study course within the framework of the study course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer presented the course content in an attractive manner and favoured students' involvement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer gave explanations concerning the course content and the grades received, when necessary.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer's language was clear and comprehensible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer's attitude towards students was respectful and supportive.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your comments:					
<div></div>					

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
* At the beginning of the study course the lecturer presented the goal, content, expected learning outcomes, assessment criteria and type of assessment of the course.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer was prepared and fully presented the topics defined in the description of the study course within the framework of the study course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer presented the course content in an attractive manner and favoured students' involvement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer gave explanations concerning the course content and the grades received, when necessary.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer's language was clear and comprehensible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* The lecturer's attitude towards students was respectful and supportive.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I would like to attend another course with this lecturer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your comments:					
<div></div>					

* Did other lecturers participate in the implementation of the study course?

☐ Yes ☐ No

Organisation of the study process and learning environment

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Not applicable
* Premises and equipment were suitable for the acquisition of the study course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* Information about the place and time of lectures and classes was clear and accurate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Your comments:

* Organisation of the study process and learning environment - personal input The average number of hours per week which I spent to acquire this study course independently

☐ Less than 1 hour ☐ 1 - 2 hours ☐ 3 - 4 hours ☐ 5 - 10 hours ☐ 11 and more hours ☐ Not applicable

Organisation of the study process and learning environment - personal input Your comments about the study course

Send

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